THE PLACE OF EARTH AND SPACE SCIENCE AND ENGINEERING DESIGN IN THE NEXT GENERATION SCIENCE STANDARDS

By
Nelson N. Ngoh, Ph.D., Graduate School of Education
Jani M. Pallis, Ph.D., School of Engineering
University of Bridgeport, Bridgeport, CT
March 24, 2017

ABSTRACT

The Next Generation Science Standards (NGSS) were? recently adopted by the state of Connecticut. This paper describes the status of Earth and Space Science (ESS) and Engineering Design (ED) within the NGSS in the state of Connecticut. In this research, Connecticut District Science Coordinators were targeted. They were given questionnaires through *Survey Monkey* to obtain their views and experiences on the issue of teacher preparedness. Results showed that the ESS and ED did not yet occupy a high position in the state curriculum. There are several challenges to be faced to have ESS and ED status improved in the state. The adoption in itself was seen to be a clear indication that ESS and ED will gradually assume a high recognition in the curriculum of Connecticut schools.

INTRODUCTION

The engagement of today's K-12 students in Earth and Space Science (ESS) is specifically aligned with two of NASA's Strategic Enterprises: Mission to Planet Earth and Space Science.. That is, we noticed that there was a greater emphasis now in ESS within NGSS than in the Connecticut Core Science Curriculum Framework. We learned that in some districts there was currently no Space Science taught in middle and high school and that the highest grade in which Earth Science is taught is grade 6. Working with a grant from the NASA Connecticut Space Grant Consortium, we then saw a need and opportunity to conduct an educational research study to survey Connecticut K-12 science coordinators for increased instruction in pre-college ESS within Connecticut. The main purpose was to determine and identify: a) concerns about the adoption of the NGSS related to ESS and, b) challenges, needs and steps which can be taken to increase ESS instruction in grades K-12 within Connecticut. Our survey was to further determine how Connecticut science teachers were prepared to handle this ESS. That is, the survey results could serve in part as a needs assessment and a logistic map/strategy to increase ESS K-12 education and relevant professional development in the state.

RESEARCH METHODOLOGY

Upon confirmation of the award, the researchers invited potential members and other stakeholders to participate in a brainstorming session to assist in identifying needs and potential areas of concern for science coordinators. These potential members included faculty and evaluation staff at the University of Bridgeport from Education, Engineering, Arts and Science and the Provost's Office, a member of the Connecticut State Department of Education Office of Higher Education, a representative from the Connecticut Science Teacher Association, a representative from the Connecticut Science Supervisors Association, a museum director (representing informal science) and two representatives from Connecticut state-identified high-needs school districts. The group was charged with initial identification of existing issues and concerns related to current K-12 instruction of ESS under Connecticut Content Science Standards and issues and concerns related to implementation of K-12 instruction of ESS under NGSS. Discussion of needs and an infrastructure to support a transition to NGSS was welcomed. The group also assisted with the ideas for the formulation of the questionnaire.

Our investigative team, composed of Dr. Nelson Ngoh from the Graduate School of Education and Dr. Jani Pallis from the School of Engineering, embarked on developing a questionnaire for the respondents to elicit their views on the adoption of NGSS and more specifically the place of ESS in this NGSS. Additionally, we were interested in knowing how prepared the state of Connecticut was for the increased ESS and Engineering Design in the NGSS. An initial survey based on the recommendations of the brainstorming group was drafted and piloted with School of Education students who are generally pre-service teachers and members of the brainstorming group. This was to assure the survey questions were clear and interpreted correctly by final survey participants. The survey addressed areas related to adoption of NGSS, needs assessment and professional development and improvement plans related to ESS. Discussions were held with the university Institutional Review Board (IRB) to make sure the rules and expectations of the IRB were in place to guarantee participants' confidentiality. Requirements included researchers and Graduate Assistants undergoing a training course by the Collaborative Institutional Training Initiative (CITI) Program.

Under the direction of the PI, the team's student research assistants obtained contact information for all of the over 160 school districts in Connecticut. After verification, we targeted 116 active Science Coordinators as our sample. An invitation was drafted requesting support of the project and sent to each superintendent and science coordinator in Connecticut to ensure the correct individual in the district was contacted for participation. An introductory invitation letter was attached, summarizing the purpose of the research and what the research was all about and appealing to respondents to participate massively in this research venture. Also, an electronic survey consent letter to the respondents highlighted the fact that participation in this research study was voluntary. The letter reiterated the point that we were not collecting any identifying information and therefore we were going to do our best to protect their confidentiality. The university's IT department was contacted to assist with the *Survey Monkey* and the survey was made available through this secure website. The study was conducted over a four-week timeframe.

RESPONSE RATE

The results of the survey came in. The response rate was not wonderful, perhaps due to the limited timeframe. Out of the 116 targeted, 16 email addresses bounced back leaving us with 100 participants out of which only 14 School Districts, representing basically all areas of the state, actively took part in the survey. The data obtained adequately answered our concerns relative to the issues and challenges resulting from the inclusion of ED and ESS in the newly adopted NGSS in K-12 science program in Connecticut. Totals and statistical variations were tallied. A summary of any additional comments on the surveys were documented.

DATA ANALYSIS

The data shows that 64.29% of the schools in the district were not yet using the Next Generation Science Standards (NGSS). Only 57.14% of the participating districts were still using the Connecticut Core Science Standards (CCSS) because CT just adopted the NGSS in November 2015. Coordinators accepted that the teaching of the sciences in their district was specialized into biology, chemistry, physics, and earth and space science. Some of them (50%) were concerned with administrative requirements, development, and implementation of these standards but as much as 42.86% seemed not to be concerned. Only 57.14% agreed that there is lack of comprehensive science-based professional development related to the implementation of new areas under NGSS. It was alarming to see that 64.29% accepted that there were cases of teachers with a background in non-STEM disciplines who taught science in their school districts. It was therefore understood when 85.71% agreed that training and refresher courses may be necessary for NGSS to bring in more educators with science background, to not only provide educational support but further model cross functional education. They pointed out that discussions with principals would provoke change in the curriculum. The blended science teaching approach ought to be adopted.

CONCLUSION and RECOMMENDATION

The adoption by CT of the NGSS is a welcome idea by the district science coordinators. However, there are several challenges to be faced to have ED and ESS status improved in the state. It is not even certain when implementation will start. Very few schools are already using the NGSS. Some of the challenges include the lack of materials and resources and the lack of certified science teachers for ESS. Teachers in schools and even parents still see this concept as new. They are used to biology, chemistry and physics and that is why they see, as a solution of this problem, the integration of ESS into the existing science subjects. The relevance of the ESS in the lives of students and parents particularly as it concerns job opportunities is highly recommended for making conspicuous attraction to the subject. It is still believed that the state stepping in to increase its support and coordination of the development of the curriculum can be of great assistance in giving the push ESS and ED deserve. Many still see well organized professional developments, workshops and refresher courses as a key for a step forward. They think very highly that collaboration with universities in the state in various domains would make the growth much easier and meaningful. On the whole, the adoption of NGSS is a clear indication that ESS and ED will be gradually provided reasonable status enjoyed by other subjects in the curriculum.

REFRENCES

NASA, Strategic Enterprises, www.hg.nasa.gov/office/codez/stratplans/1996/enterpri.html.

NASA Strategic Plan 2014. http://1www.nasa.gov/sites/default/files/files/FY2014 NASA SP 508c.pdf

Next Generation Science Standards, www.nextgenscience2015.Achieve.lnc.

NGSS Middle School Earth and Space Sciences, http://www.nextgenscience.org/sites/ngss/filesESS%20MS%20Storylines%20Topics%205.14.13.pdf, Achieve, lnc.

NGSS High School Earth and Space Sciences, Achieve, Inc. http://www.nextgenscience.org/sites/ngss/filesESS%20HS%20Storylines%20DCI.pdf.Achieve, lnc.

CT State Board of Education. Next Generation Science Standards. htt://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=320890